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Submerged Aquatic Vegetation Survey

A Study Completed for the Southport Project, Philadelphia, Pennsylvania

Prepared By
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The Southport Project is a waterfront redevelopment endeavor that proposes to dramatically modify the shoreline of the Delaware River, south of Windy Point within the eastern edge of the Philadelphia Naval Yard. In the redevelopment process, alterations to the littoral and sub-littoral zone will occur. To accomplish this task, environmental permits will be required and part of this permit process will address the natural resources associated with the sub-tidal habitats.

Independent studies completed for benthic animals, fishes and terrestrial organisms have already been prepared. The search for submerged aquatic vegetation (SAV) will complement the existing resource studies and complete the ecosystem analysis required for the environmental permit review. SAV is composed of suite of vascular and non-vascular plants capable of surviving in the aqueous environment. A plethora of literature has been written on the topic, focusing on the biological, chemical and sediment segments to this ecosystem. It is well known many SAV have specific preferences for substrates, light and other important aquatic features. The Southport location (Figure 1) is unique, occupying a portion of the freshwater tidal Delaware River. This part of the river is named Horseshoe Reach and is the western edge of the Port of Philadelphia's Shipping Channel. The position near the base of the Walt Whitman Bridge places the site above the northern normal seasonal saline isohaline. Similar freshwater tidal habitats in Eastern North America support similar freshwater tidal environments and have typical representative genera: *Anacharis, Ceratophyllum, Hydrilla, Najas, Potomogeton, Scirpus, Eleocharis, Vallisneria, Zannichellia, Chara, & Nitella*. If habitat exists these would be targeted by the study.

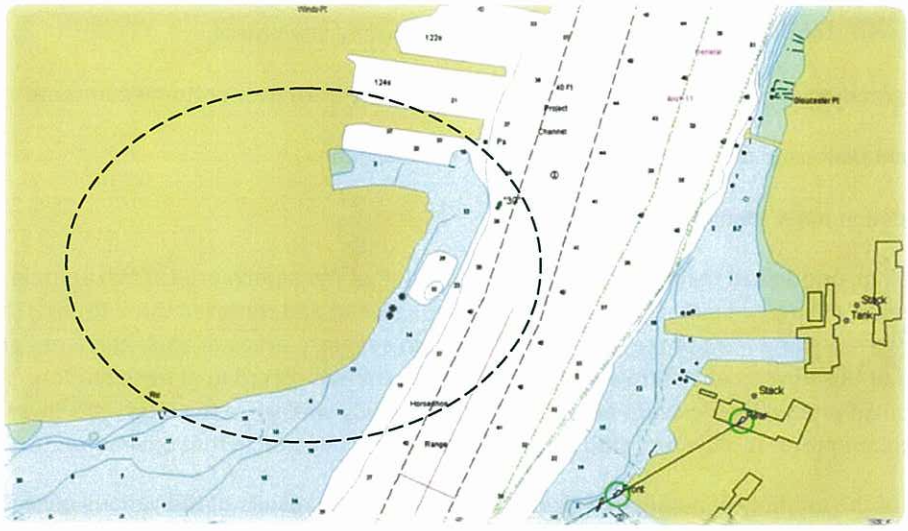

Figure 1: Southport Project Area (oval) shown on Garmin Blue Water Navigation Chart

Freshwater tidal and sub-littoral habitats are special for a variety of reasons, many centered on the limited available habitat. The coincidence of human port activities and the tidal portion of the river have influenced the SAV distribution, limiting the resource to small beds associated with the few river shallows. This limited resource has been deemed important by most environmental regulatory agencies. USACOE and its reviewing partners (USFWS, NMFS, and NPS) and similar State regulatory authorities have permit requirements that demand data to accurately assess the proposed project's impact on natural resources. This survey, as documented in this summary report, serves to determine the presence or absence of SAV and their extent within the Southport Project area.

Study Objective

The SAV survey objective is to determine if submerged aquatic plants occupy any part of the suitable habitat found in the sub-littoral portion of the Southport Project area.

Study Goal

The primary study goal is to provide the physical labor and field time necessary to sample the aqueous project area for SAV. This study uses standard de novo search protocols to make the presence or absence determination. A second goal of the study would document the extent of SAV if such species are encountered during the sampling effort. This would be accomplished using the evidence collected by the site sample protocol and the best interpretation of the principal scientist.

Methods

Southport's survey followed standard SAV collection protocols. SAV sampling the Southport Project area used simple equipment to collect from the sub-littoral area surrounding the project site:

- 14'gas engine propelled flat bottom boat equipped with an electronic depth sounder, Garmin GPS III *plus*, VHF Com radio, 16' Push pole and standard safety equipment.
- Weighted double sided rake used to collect specimens from river bottom sediments
- Secchi Disk used to document the river light penetration
- Collection bags, identification tags

Depth recordings and secchi readings assisted the definition of the search area. Each sample point was sampled from an anchored boat. The collection rake was tossed and retrieved three times. The tosses were 90°s to the two sides and front of the boat, collecting from separate areas at each anchored point. Data on the presence or absence on each throw and species if present was recorded at each station. The boat was motored or poled around the northern quite portion of the study site, while the Delaware River edge study segment required power to slow and drop anchor for samples collected in that environment.

An estimate of the quantity of population size was made from the results of the various collection tosses as well as the corresponding depths. The SAV bed size is estimated based on the presence of collected specimens. Waypoints collected on its perimeter provide an aerial measurement and specific location to the presence or absence determination.

The tidal regime requires special SAV collection consideration. The tidal water fluctuations in this part of the river can exceed 5-6'. Sampling at high tide can be difficult and may not provide an accurate assessment. Enhanced search conditions are found 1.5 hours on either side of the low tide, so sample timing relied on the tidal predictions provided by NOAA at http://tidesandcurrents.noaa.gov/.

The sampling goal was to observe the Southport tidal environment during the peak growing period during a low tide predicted during the mid-morning to early afternoon. This timing is necessary sample when the submerged aquatic vegetation would be most visible while providing safe sampling conditions. The information gathered during this sampling event is presented in the Results section of this summary report.

Results

The SAV survey occurred during a morning low tide (9:45AM PLT) on June 27, 2010. The principal scientist and assistant launched the flat bottom boat at 6:30 AM EST and motored to the Southport site. Sampling began around 7:00AM in the ship slip located at the northeastern edge of the project area. Eight sample points in the ship slip and 6 sample points on the Delaware River shoreline resulted in 42 sub-sample collections. These samples resulted in the identification of SAV in the ship slip as well as along the river.

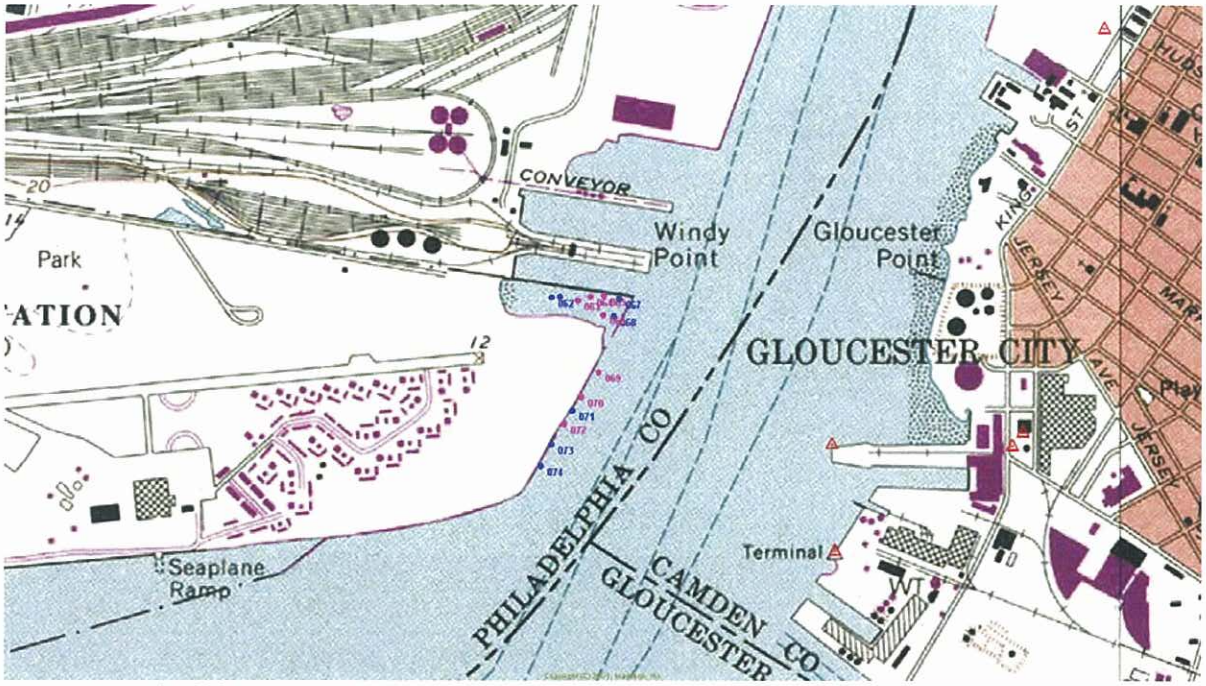

Figure 2: USGS Philadelphia, PA topographic quadrangle illustrating sample points: SAV present (pink) absent (blue)

The sampling effort resulted in the identification of SAV at 50percent of the anchored stations. It found SAV on 35.7 percent sample tosses where two SAV species were identified. Wild celery (*Vallisneria americana*) and musk grass (*Chara vulgaris*) have representative populations within the Southport Project aqueous habitat. Wild celery and musk grass have been found in the ship slip. Sample points 61 through 68 found wild celery at 50 percent of the sample stations. It was found in the center of the slip where the depth of the water at low tide is sufficient to cover the plants yet shallow enough to provide ambient light to provide photosynthesis. Based on the depth readings made during the survey, the population is confined to the water with depths between 3 and 6 feet MLW. Secchi readings indicate light penetration is restricted to the upper three feet (31-38") of the water column. The shallower areas receive saturation whereas the deeper areas the light reached the upper unfolded leaves of the deepest plants. Specimens collected during the sampling effort exhibited two distinct growth forms attributed to the depth in which the specimens were collected. Shallow water collections in less than 3 feet (JRA #2238; 2251) had stunted and deep green robust leaves weathered by wave action and saturated by sunlight. The deeper specimens (JRA #2247; 2261) had lighter green thin leaves with long twisted blades typical of specimens found on the limit of their depth distribution. The second species found in the collection effort was musk grass. This is a non-vascular alga that is found with and in slightly more extreme conditions than wild celery. Musk grass was found intermixed with wild celery in the ship slip and as small discrete, isolated patches along the river's edge. Table 1 provides the results of the sampling for SAV.

Two addition species were collected in the project area as floating specimens. *Potamogeton pusillus* and *Ceratophyllum demersum* were found inter-twined at station #061 within the ship slip. The providence of these specimens is unknown, but is expected to have been transported from a regional population by the tides and wind.

Table 1: Sample Results from June 27, 2010 SAV Study

Sample	GIS Lat/Long	Location	Rake Pull 1	Rake Pull 2	Rake Pull3	Secchi	Depth
61	39.89406109 75.14124879 4571790.34953989 2030901.75488216	Slip	0*	0	0	To bottom	30"
62	39.89403963 75.14149555 4571783.555464 2030880.99273995	Slip	0	0	0	To bottom	32"
63	39.89398062 75.14071235 4571790.90197014 2030949.82919982	Slip	*Chara*	*Chara*	*Vallisneria*	36-38"	36"
64	39.89406645 75.14034220 4571807.09281681 2030979.7332058	Slip	*Vallisneria, Chara*	*Vallisneria*	*Vallisneria, Chara*	38"	38"
65	39.89407718 75.13991833 4571815.84111371 2031016.00132361	Slip	*Vallisneria*	*Vallisneria, Chara*	*Vallisneria, Chara*	36"	38"
66	39.89364266 75.13995060 4571766.66873771 2031023.26695606	Slip	*Vallisneria*	*Vallisneria, Chara*	*Vallisneria*	39"	48"
67	39.89400744 75.13946244 4571816.15988712 2031056.88839648	Slip	0	0	0	33"	60-72"
68	39.89361048 75.13962337 4571768.89703588 2031052.20183797	Slip Mouth	0	0	0	35"	8-9'
69	39.89230692 75.14008471 4571614.88811027 2031042.59358767	Slip Mouth	*Chara*	0	0	34	13'
70	39.89173293 75.14061042 4571541.33002158 2031010.57173342	Delaware	*Chara*	0	0	31	4'
71	39.89142716 75.14087864 4571502.35570713 2030994.53224431	Delaware	0	0	0	36"	4-5'
72	39.89111602 75.14112004 4571463.25844458 2030980.92726046	Delaware	*Chara*	0	0	35"	7'
73	39.89064395 75.14149019 4571403.869844 2030959.94967374	Delaware	0	0	0	35"	10'
74	39.89014506 75.14180669 4571342.43703585 2030944.21365216	Delaware	0	0	0	36"	12-15'

Population Size

Sample waypoints 75 through 87 surround the SAV bed in the ship slip. It corresponds to the light and depth limits associated with the collected specimens. Not shown in Figure 3 are the sample points along the edge of the river. Points #69, 70 and 72 are isolated small patches that were attached or between the concrete rubble of which the shoreline is composed. The eastern limit for both the ship slip and the shore line is the 1 fathom line (6'). Deeper than this the light is significantly reduced. The water depths drop into the shipping channel quickly beyond the eastern 1-fathom limit, reaching 12-15' within a few feet. The shore line collections are located within a few feet of the Delaware River shoreline where a single pull success identified *Chara* for each station.

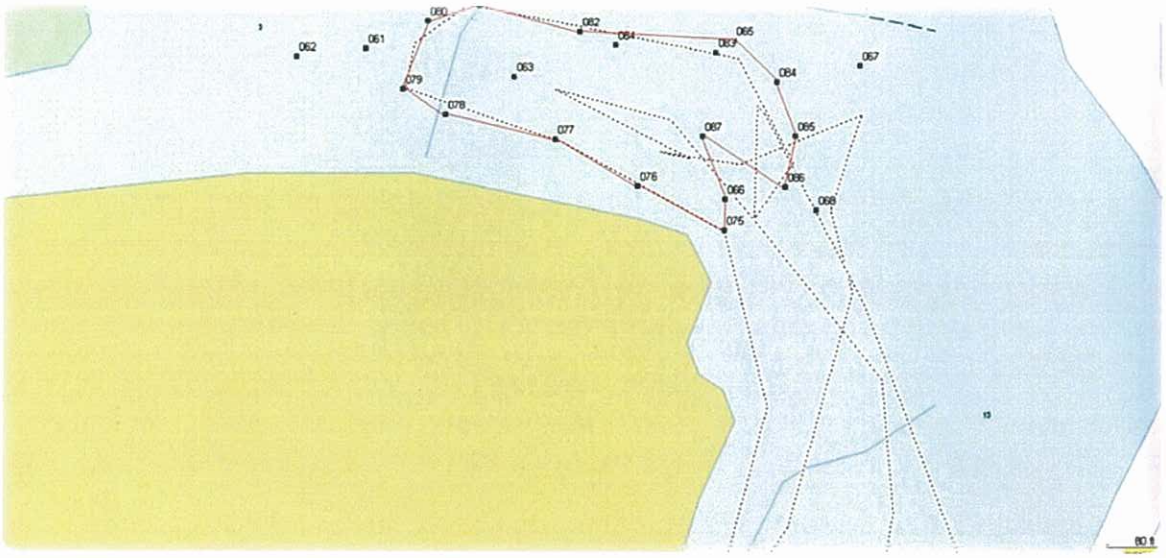

Figure 3: SAV bed (red line) surrounds *Vallisneria* and *Chara* habitat. The bed size is approximately 1.1 acres (49,920 SF).

The wild celery population is distributed evenly within the identified habitat. The quantity of vegetation retrieved during each successful sample pull was characterized by the consistent gradient between few and many from exposed to covered habitats. It was less dense and stunted in the western, shallower waters of the slip and it was denser and robustly vegetated with well developed blades and flowering stalks on the deeper edges of the bed.

Musk grass, on the other hand, appeared to be evenly distributed in the slip where suitable habitat existed, from its first identification to the edge of its presence. Its form and quantity was consistent: it was best represented on the outer edges of the wild celery bed, probably due to available rooting space and available light. The river edge population is sparse and exists as discrete isolated patches in shallow water confined to a few feet from the river's low water edge.

Conclusions

SAV have been discovered in the Southport Project area's tidal waters. Two species **wild celery and musk grass** have been discovered rooted in the project area. Wild celery and musk grass occupy approximately 1 acre of suitable habitat, with the bulk of the SAV being located within the ship slip.

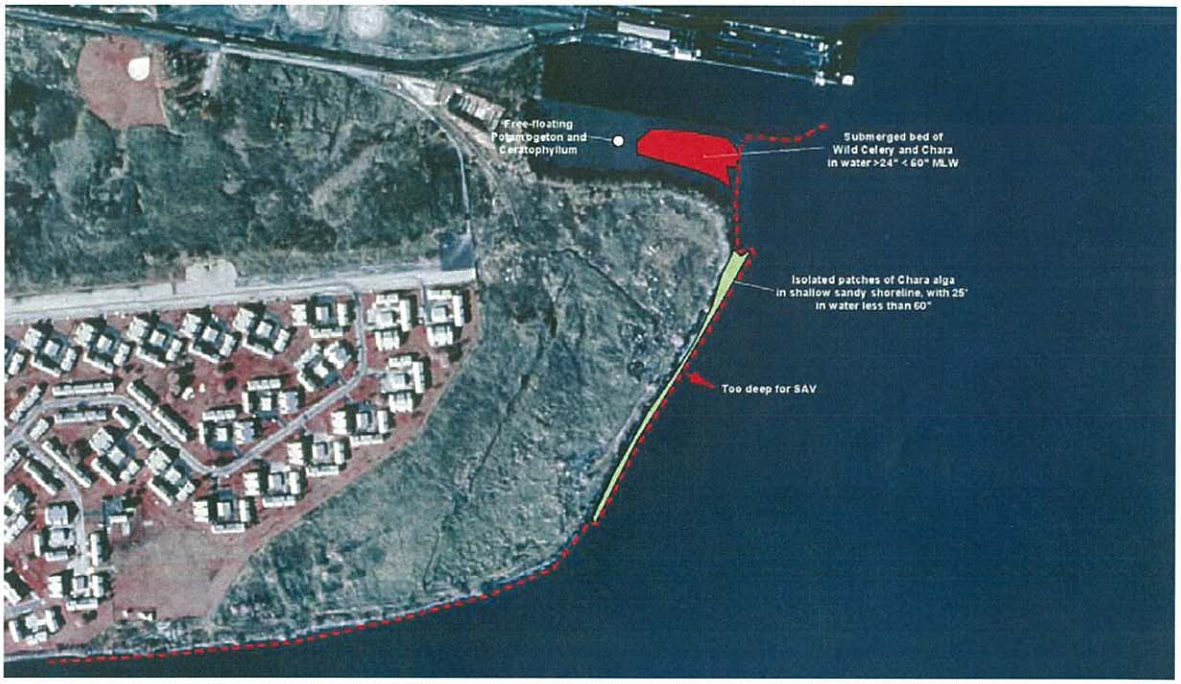

Figure 4: Approximate location of SAV bed (red) and scattered plants (green) on South port Project Site, (NJDEP 1995 IRC)

The SAV is restricted to waters less than 6' MLW and greater than 2', limited by exposure and light penetration. Habitat meeting these limitations exists in the ship slip and along an extreme narrow area on the Delaware River shoreline. Vascular species, wild celery, is restricted to the fine silt mud substrates in the ship slip. The shoreline habitat is compromised by limited suitable substrate as well as depth. Most of the river shoreline is composed of concrete and stony rubble with no more than an occasional few square feet of potential SAV habitat interspersed among the large construction debris and stony rubble fill materials.

Additionally, the water along the shoreline drops off to depths greater than 6' within 25' of the low tide shoreline, further reducing suitable SAV conditions. This has been demonstrated by the few samples of musk grass collected along this portion of the project area.